REMARKS

Claims 1-44 are pending. The Office Action dated January 31, 2003, has been carefully considered. New Claims 31-44 have been added to further define aspects of the present invention for which applicants believe are patentable. Applicants request that the Examiner consider the above amendments and the following remarks, and pass the application to allowance.

Response to 35 U.S.C. § 102(e) Rejections:

Claims 1-5, 9-13, 19, and 20 were rejected under 35 U.S.C. § 102(e) as being anticipated by Ochoa et al. (U.S. Patent No. 6,054,682).

Claim 1 as amended recites a component placement machine for placing components on printed circuit boards. The machine includes a dry atmosphere component storage area, wherein the component storage area maintains a dry atmosphere without baking the components; a component placement system for taking components from the component storage area and placing the components on the printed circuit boards; an enclosure surrounding the component storage area; and a dry gas delivery system for delivery of a dry gas to the storage area to maintain a dry atmosphere and to prevent moisture from being absorbed by the components.

As set forth in the specification, plastic cases for electronic active components or integrated circuits are gaining in popularity over ceramic or metallic packages as they are easier to work with and less expensive, however, they are sensitive to moisture. Typically, moisture from atmospheric humidity is absorbed by the package via permeation. If the moisture level inside the package reaches a critical point, the device may be damaged when brought up to temperature during the reflow soldering process. These types of moisture induced failures are referred to as the popcorning effect due to the audible popping when a crack appears in the package from moisture over pressure. If cracking occurs, air and moisture may contact the silicon die inside the package resulting in corrosion. The

reliability of the product is seriously jeopardized if an integrated circuit package cracks during reflow. Micro-cracking is also hard to detect. Therefore, it is critical for printed circuit board assemblers to avoid moisture induced failures and popcorning defects and to limit the exposure of components to moisture.

There are currently no specific solutions to prevent the absorption of moisture. Assemblers normally adopt a "moisture management system" in order to control the moisture exposure levels. A part of such a system involves re-bagging the components in dry and desiccant bags after an initial usage. Another part of the current practice is to monitor floor life of a component or the time that the component is exposed to atmospheric moisture. After a floor life has expired, the moisture in the package may be reduced by performing a process referred to as "baking" during which the component is heated to remove moisture. The present invention addresses the moisture problem by providing a system which eliminates the need for the baking process and other moisture management issues, and still prevents moisture absorption and the associated moisture induced failure, including popcorning.

Ochoa et al. relates to a system and method for "removing water vapor trapped in integrated circuit (IC) packages, and more particularly, to a method and system which removes trapped water vapor in IC packages immediately prior to reflow soldering of the IC onto a circuit board as part of the in-line assembly process." (Emphasis added.) Col. 1, lines 6-12. The system of Ochoa et al. includes a thermal chamber for receiving a plurality of components therein and for heating the plurality of components at a predetermined temperature for a predetermined length of time. An outfeed slot located on a wall of the thermal chamber allows at least one component from the plurality of components to pass there through and emerge externally of the thermal chamber. A pick and place machine, located adjacent to the thermal chamber, automatically retrieves the components which have passed through the outfeed slot and places the components onto a designated circuit board.

As set forth above, the system and method of Ochoa et al. require heating (i.e., baking) of the components immediately prior to placement of the components onto a circuit board. The present invention, however, does not require baking of the components prior to placement of the components on the printed circuit board since the components of the present invention are stored in a dry atmosphere component storage area.

In addition, Ochoa et al. does not teach or suggest a dry gas delivery system for delivery of a dry gas to the storage area to maintain a dry atmosphere and to prevent moisture from being absorbed by the components. Rather, in Ochoa et al. "a pressurized control system is attached to the thermal oven described above to maintain a pressure other than atmospheric within at least a portion thereof. Ideally, a vacuum is maintained within the oven during heating, thereby reducing the water vapor pressure within the oven and allowing for the use of lower conditioning temperatures, or alternatively, reduced conditioning times at the same temperature. Additionally, an inert gas or other fluid may be used to purge the oven during operation, or during periods of non-use, if desired." Col. 4, lines 58-67.

As set forth above, Ochoa et al. does not teach or suggest a dry atmosphere component storage area. Rather, the component chamber 111 of Ochoa et al. is a thermal chamber or oven which receives a plurality of components and is then heated to a predetermined temperature for a predetermined period of time to remove water vapor. Ochoa et al. also does not teach or suggest a dry gas delivery system to maintain a dry atmosphere in the component storage area. Accordingly, since Ochoa et al. does not teach or suggest component placement machine for placing components on printed circuit boards having a dry atmosphere component storage area, including a dry gas delivery system, or a component storage area which maintains a dry atmosphere without baking, Claim 1 should be allowable. Claims 2-5, 19 and 20 are dependent from Claim 1 and should also be allowable for the reasons set forth above.

Claim 9 recites a method of mounting electronic components on a printed circuit board. The method includes storing electronic components in a dry atmosphere in a storage area of a surface mount device placement machine, wherein the dry atmosphere is maintained without baking the components; maintaining the dry atmosphere in the storage area by enclosing the storage area and injecting dry gas into the storage area; removing the components from the storage area; and mounting the components on a printed circuit board. (Emphasis added.)

As set forth above, Ochoa et al. does not teach or suggest storing electronic components in a dry atmosphere in a storage area of a surface mount device placement machine by injecting dry gas into the storage area. Rather, "a vacuum is maintained within the oven during heating, thereby reducing the water vapor pressure within the oven and allowing for the use of lower conditioning temperatures, or alternatively, reduced conditioning times at the same temperature. Additionally, an inert gas or other fluid may be used to purge the oven during operation, or during periods of non-use, if desired" by injecting dry gas into the storage area. (Emphasis added.) Col. 4, lines 58-67. Accordingly, since Ochoa et al. does not teach or suggest storing electronic components in a dry atmosphere in a storage area of a surface mount placement machine, wherein the component storage area maintains a dry atmosphere without baking the components, Claim 9 should be allowable. Claims 10-13 are dependent from Claim 9 and should be allowable as set forth above.

Response to 35 U.S.C. § 103(a) Rejections:

Claims 6-8, 14-17, and 21-30 were rejected under 35 U.S.C. § 103(a) as being anticipated by Ochoa et al. (U.S. Patent No. 6,054,682) in view of Vander Velde (U.S. Patent No. 5,365,779).

Claim 6 recites a component placement machine for placing components on printed circuit boards. The machine includes a component storage area, wherein the component

storage area maintains a dry atmosphere without baking the components; a component placement system for taking components from the component storage area and placing the components on the printed circuit boards; an enclosure surrounding the component storage area; and a dry gas delivery system for delivery of the dry gas to the storage area to maintain the dry atmosphere and to prevent moisture from being absorbed by the components, wherein a flow rate of the dry gas delivered to the storage area is controlled by a control system including a humidity sensor within the component storage area.

Vander Velde relates to a method and apparatus for the corrosion condition evaluation of unbonded prestressing elements in post-tension concrete structures. The method involves locating a prestressing element in the structure and providing at least two openings in the structure at positions along the length of the element. One of the openings is an inlet port 20 and the other is an outlet port 26, each of the ports permitting communication with the gaseous environment within a conduit surrounding the prestressing element. The gaseous environment is accessed through the outlet port 26 by extracting a sample of gas there through. The sample is then measured by a sampling and measurement station 30 to determine its humidity and evaluate the corrosion condition of the prestressing element between the inlet port and the outlet port. As shown in FIG. 1, the sampling and measurement station 30 is connected from the outlet port 26 via gas discharge line 28. Thus, the gaseous environment is accessed through the outlet port by extracting a sample of gas which is then measured by the sampling and measurement station 30 to determine its humidity. Accordingly, since Vander Velde does not teach a humidity sensor within the component storage area, Claim 6 should be allowable. Claim 25 is dependent from Claim 6 and should also be allowable.

Claim 7 recites a component placement machine for placing components on printed circuit boards. The machine includes a component storage area, wherein the component storage area maintains a dry atmosphere without baking the components; a component

placement system for taking components from the component storage area and placing the components on the printed circuit boards; an enclosure surrounding the component storage area; and the dry gas delivery system for delivery of a dry gas to the storage area to maintain a dry atmosphere and to prevent moisture from being absorbed by the components, wherein the dry gas is delivered to the component storage area at a first flow rate when the storage area is open and is delivered at a second flow rate when the storage area is closed.

Vander Velde, however, does not teach or suggest that the dry gas is delivered to the component storage area at a first flow rate when the storage area is open and a second flow rate when the storage area is closed. Rather, in Vander Velde, a regulator means is used to regulate pressure and flow rate of the dry gas "whereby said gaseous environment within the conduit means is subjected to a flow of said dry gas from said supply means and through said inlet port, said regulator means being adjusted to provide said flow of dry gas at a pressure for a time sufficient to extract a sample of said gaseous environment through said outlet port to said means for sampling an measurement of humidity of said sample and thereby evaluate the corrosion condition of said prestressing element between said inlet port and said outlet port." Col. 5, lines 23-33. Furthermore, although Vander Velde describes a first flow rate for an unobstructed flow and a second flow rate which is higher for a block conduit, the flow rates do not correspond to a flow rate for when the storage area is open requiring a relatively high first flow rate and a second lower flow rate for maintenance when the storage area is in a closed position. Accordingly, Claim 7 should be allowable. Claims 8 and 26-29 are dependent from Claim 7 and should be allowable for the reasons set forth above.

Claim 14 recites the method of Claim 9, wherein the dry atmosphere in the storage area is provided by delivering a dry gas to the storage area. As set forth above, Ochoa et al. does not suggest or teach storing electronic components in a dry atmosphere in a

storage area of a surface mount device placement machine. Accordingly, Claim 14 should be allowable. Claims 15-17 and 30 are dependent from Claim 14 and/or Claim 16 and should be allowable for the reasons set forth above.

Claims 21-23 recite the machine of Claim 1, further comprising a flow meter for regulating the flow of the dry gas to the storage area; further comprising a multiplicity of inlets to provide a consistent dry atmosphere around all of the components in a storage area; and the machine of Claim 22 wherein the multiplicity of inlets includes a sprayer or a diffuser, respectively.

As set forth above, Ochoa et al. does not suggest or teach storing electronic components in a dry atmosphere in a storage area of a surface mount device placement machine. In addition, the disclosure of Vander Velde, even if combined with Ochoa et al., does not overcome the deficiency of Ochoa et al. for the reasons set forth above. Accordingly, Claims 21-23 should be allowable.

Claims 24, 25, 29 and 30 recite the machine or method of Claims 1, 6, 7 and 9, respectively, wherein the components to be placed on the printed circuit boards maintain a dry atmosphere without heating.

As set forth above, Ochoa et al. relates to a system and method for "removing water vapor trapped in integrated circuit (IC) packages, and more particularly, to a method and system which removes trapped water vapor in IC packages immediately prior to reflow soldering of the IC onto a circuit board as part of the in-line assembly process." Col. 1, lines 6-12. Meanwhile, Vander Velde relates to a method and apparatus for the corrosion condition evaluation of unbonding prestressing elements in a post-tension concrete structures.

Accordingly, the rejection fails to establish a prima facie case of obviousness. Namely, there is no suggestion or motivation to modify Ochoa et al. to include a dry gas

delivery system for delivery of a dry gas to the storage area, wherein the components to be placed on the printed circuit board maintain a dry atmosphere without heating, since such a modification of Ochoa et al., would, in effect, destroy the objective or function sought to be achieved by Ochoa et al., i.e., a system for removing trapped moisture by heating the components for a predetermined temperature at a predetermined period of time immediately prior to reflow soldering of the integrated circuit onto a circuit board. In addition, the disclosure of Vander Velde, even if combined with Ochoa et al., does not overcome the deficiency of Ochoa et al. for the reasons set forth above.

Accordingly, since Ochoa et al. does not suggest or teach storing electronic components in a dry atmosphere in a storage area of a surface mount device placement machine, Claims 24, 25, 29 and 30 should be allowable.

Claim 18 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ochoa et al. in view of Alles et al. (U.S. Patent No. 5,297,438).

Claim 18 recites the method of Claim 9, further comprising removing about 0.1% or more of the weight of the component by elimination of moisture while the components are stored in the storage area.

Alles et al. relates to an electrical circuit containing a piezoresistive sensor, including passing the filter cake to an "oven 94, in which it is preferably dried to a moisture content of less than about 1.0 weight percent. In one embodiment, the filter cake is dried at a temperature of about 105 degrees Celsius for about 1 hour." Col. 8, lines 60-64.

As set forth above, Ochoa et al. does not suggest or teach storing electronic components in a dry atmosphere in a storage area of a surface mount device placement machine. Accordingly, Claim 18 should be allowable.

New Claims 31-44:

Claims 31-33 recite the machine of Claim 1, wherein the dry gas removes at least 0.1% of the weight of the component; wherein the dry atmosphere is maintained without heating the dry gas above about 50° C; and wherein the dry gas is nitrogen, respectively. Support for these new claims is provided in the specification at page 8, lines 20-23; page 6, lines 14-16; and page 9, lines 4-5, respectively.

For the reasons set forth above as to Claim 1, and further since none of the art teaches or suggests maintaining a dry atmosphere without heating the dry gas above about 50° C, Claims 31-33 should be allowable.

Claims 34-36 recite the machine of Claim 6, wherein the dry gas removes at least 0.1% of the weight of the component; wherein the dry atmosphere is maintained without heating the dry gas above about 50° C; and wherein the dry gas is nitrogen, respectively.

For the reasons set forth above as to Claim 6, and further since none of the art teaches or suggests maintaining a dry atmosphere without heating the dry gas above about 50° C, Claims 34-36 should be allowable.

Claims 37-39 recite the machine of Claim 7, wherein the dry gas removes at least 0.1% of the weight of the component; wherein the dry atmosphere is maintained without heating the dry gas above about 50° C; and wherein the dry gas is nitrogen, respectively.

For the reasons set forth above as to Claim 7, and further since none of the art teaches or suggests maintaining a dry atmosphere without heating the dry gas above about 50° C, Claims 37-39 should be allowable.

Claim 40 recites a method of handling electronic components for printed circuit boards, the method comprising: receiving an electronic component in a sealed package; removing the component from the sealed package; placing the component into a dry

atmosphere component storage area; and maintaining the dry atmosphere in the storage area by enclosing the storage area and injecting a dry gas into the storage area.

Since none of the prior art teaches or suggests receiving and placing an electronic component into a dry atmosphere and maintaining the dry atmosphere in the storage area by enclosing the storage area and injecting a dry gas, Claim 40 should be allowable. Claims 41-44 are dependent from Claim 40 and should be allowable for the reasons set forth above.

CONCLUSION

It is respectfully submitted that Claims 1-44 are presently in condition for immediate allowance, and such action is requested. If, however, any matters remain that could be clarified by Examiner's Amendment, the Examiner is cordially invited to contact the undersigned by telephone at the number below.

Respectfully submitted,

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